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- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: LUMINESCENCE SPECTRAL PROPERTIES OF CdS NANOPARTICLES

(57) Abstract: The steady state and time resolved luminescence spectral properties of two types of novel CdS nanoparticles and nanoparticles are described. CdS nanoparticles formed in the presence of an amine-terminated dendrimer show blue emission. The emission wavelength of these nanoparticles depended on the excitation wavelength. The CdS/dendrimer nanoparticles display polarized emission with the anisotropy rising progressively from 340 to 420 nm excitation, reaching a maximal anisotropy value in excess of 0.3. A new constant positive polarized emission from luminescent nanoparticles is also described. Polyphosphate-stabilized CdS nanoparticles are described that display a longer wavelength red emission maximum than bulk CdS and display a zero anisotropy for all excitation wavelengths. Both nanoparticles display strongly heterogeneous intensity decays with mean decay times of 93 ns and 10 μ s for the blue and red emitting particles, respectively. Both types of nanoparticles were several times more photostable upon continuous illumination than fluorescein. In spite of the long decay times the nanoparticles are mostly insensitive to dissolved oxygen but are quenched by iodide. These nanoparticles can provide a new class of luminophores for use in chemical sensing, DNA sequencing, high throughput screening and other applications.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/02954

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : Please See Extra Sheet.

US CL : Please See Extra Sheet.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 524/83, 190, 413, 430, 440; 525/420, 431, 477, 540; 436/523, 524, 528, 164, 172; 423/592; 205/123, 157; 257/22, 37, 40

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONEElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST, WEST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| Y | US 5,690,807 A (CLARK Jr. et al.) 25 November 1997, col. 2, line 63-col. 3, line 57. | 1-35 |
| Y | US 5,434,878 A (LAWANDY) 18 July 1995, col. 3, line 26-col. 4, line 15. | 1-35 |
| Y | US 5,525,377 A (GALLAGHER et al.) 11 June 1996, col. 1, line 10-col. 3, line 44. | 1-35 |
| Y,P | US 6,048,616 A (GALLAGHER et al.) 11 April 2000, col. 3, line 10-col. 3, line 43. | 1-35 |
| Y,P | US 5,938,934 A (BALOGH et al.) 17 August 1999, col. 2, line 55-col. 3, line 65. | 1-35 |

☐ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

| | |
|---|--|
| * Special categories of cited documents: | *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
| *A* document defining the general state of the art which is not considered to be of particular relevance | *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
| *E* earlier document published on or after the international filing date | *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | *Z* document member of the same patent family |
| *O* document referring to an oral disclosure, use, exhibition or other means | |
| *P* document published prior to the international filing date but later than the priority date claimed | |

Date of the actual completion of the international search

16 JUNE 2000

Date of mailing of the international search report

30 AUG 2000

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/02954

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐

The additional search fees were accompanied by the applicant's protest.

☒

No protest accompanied the payment of additional search fees.

A. CLASSIFICATION OF SUBJECT MATTER:

IPC (7):

C08K 5/46, 5/23, 3/10, 3/08, 3/18; C08L 77/00; C08F 283/04, 283/00; G01N 21/00, 21/76, 33/543, 33/551, 33/544;
C01B 13/14; C25D 5/02, 7/12; H01L 29/06, 35/24

A. CLASSIFICATION OF SUBJECT MATTER:

US CL :

524/83, 190, 413, 430, 440; 525/420, 431, 477, 540; 436/523, 524, 528, 164, 172; 423/592; 205/123, 157; 257/22,
37, 40

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I, claim(s) 1-14, 26-33 and 35, drawn to nanoparticles, a process of making the particles, a process of using the particles, and an apparatus for using the particles.

Group II, claim(s) 15-23, drawn to a powder capable of fluorescing.

Group III, claim(s) 24 and 25, drawn to a composite.

The inventions listed as Groups I-III do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: according to PCT Rule 13.1, applicant is entitled to one product, one process of making the product, one process of using the product and one apparatus of using the product. However, groups I-III are drawn to three different products which lack the same special technical features such as in group II, the powder contains a fluorescing capability while the nanoparticles of group I is composed of a different texture from that of group II, particles vs. powder, and does not require the ability to fluoresce. Group III is a composite which contains an electrically non-conductive host with nanoscopic domains bound to the surface of the semiconductor, a feature which the other two groups lack.